

A survey of the terrestrial vertebrates of coastal Byron Shire

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ABSTRACT

An eight-month survey of the terrestrial vertebrate fauna of coastal Byron Shire produced records of 15 species of amphibians, 19 species of reptiles, 182 species of birds and 23 species of mammals. These results, together with records from other sources, show the area has a rich and diverse vertebrate fauna with only reptiles not well represented. Vertebrate communities were characterized by species typical of low, dense vegetation formations. The area's richness is partly the result of its position at the centre of the Macleay-McPherson overlap zone where the Torresian and Bassian faunas meet. Distinct differences were established between the vertebrate communities of vegetation growing on the low-lying, low-nutrient sands of the coastal plain (Wallum) and those of vegetation on elevated, higher nutrient meta-sediments. Past intensive land use in the south of the survey area may have caused the local extinction of one native rodent and its niche appears to have been partly filled by two other native species. No associations were found between plant structural and floristic diversity and vertebrate diversity at survey sites and results probably reflected the availability of food resources at the time of the survey. Bird communities were characterized by two migratory groups, one present during autumn and winter and the other during spring and summer. The results highlighted the importance of the coastal habitats of northern New South Wales in providing autumn and winter food resources for migratory and nomadic nectivorous and frugivorous birds and fruit-bats, and insectivorous birds. This function together with the 41 endangered and other significant vertebrate species present, and the area's biogeographical significance, make coastal Byron Shire of regional, state and national significance for wildlife conservation.

INTRODUCTION

In March 1985 the Byron Environmental and Conservation Organization (BEACON) gained Community Employment Programme funds to carry out a survey of the vertebrate fauna of coastal Byron Shire. No previous wildlife survey work had been undertaken in the area and knowledge of its vertebrate fauna was confined to isolated published records and anecdotal material, such as that earlier collected by BEACON (Byron Environmental and Conservation Organization 1981). Survey information was urgently required for land use planning because of the rapidly expanding urbanization of the area (Planning Workshop 1983).

The principal objectives of the survey were to obtain detailed information on the distribution and relative abundance of vertebrates in the Shire's remaining areas of natural coastal vegetation and to assess the importance of these habitats for wildlife conservation.

Survey Area

A section of coast 2 to 3 km wide and 28 km long (Fig. 1), with an area of 8300 ha was covered by the survey. Much of this area is low-lying coastal plain, interrupted by the Brunswick River in the north and Cape Byron and Broken Head in the south. The coastal plain is formed from deposits of stream alluvials and marine

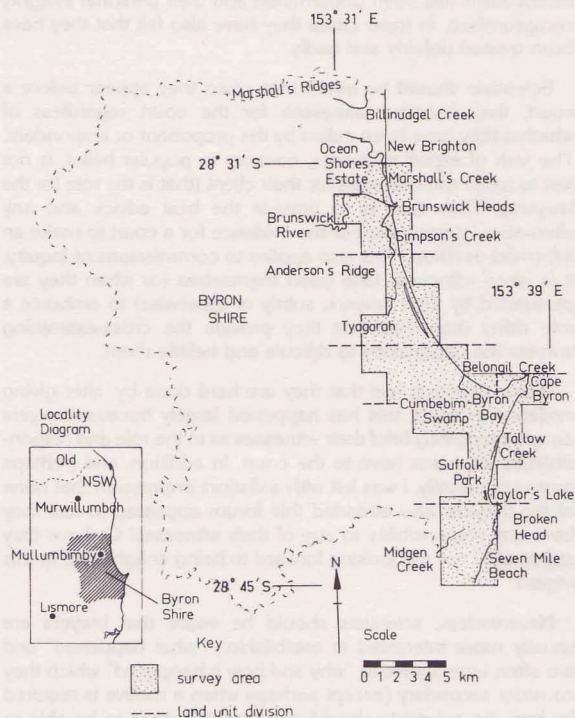


Figure 1. Locality map of coastal Byron Shire showing the area covered by the survey, defined by 1 min. latitude and longitude grid cells.

sands and the elevated headlands and ridges and composed of metamorphosed sedimentary rocks (Planning Workshop 1983). The eastern edge of the plain is marked by a series of low, parallel, dunal ridges representing old beachfronts which are separated by swales containing deposits of peat and acid, tannin-stained waters. Summers in the area are hot and winters are mild and the average annual rainfall is 1 800–1 900 mm (Planning Workshop 1983).

Vegetation

The range of vegetation types on the low-nutrient, siliceous soils of the coastal plain of north-eastern New South Wales and south-eastern Queensland comprise a biogeographic unit known as the Wallum (Coaldrake 1961). Wallum vegetation is typically composed of wet and dry heathland interspersed by wetlands ranging from sedgeland to swamp sclerophyll forest. Wet sclerophyll forest and floodplain rainforest frequently occur where soils have been enriched by alluvium.

The elevated slopes and ridges with their higher nutrient soils support more diverse forests, grading from dry sclerophyll through wet sclerophyll to subtropical rainforest. Much of the Shire's original forest cover was cleared following European settlement (Planning Workshop 1983) and present stands mainly represent secondary growth.

Seagrass beds, mangroves and saltmarshes occur at the mouths of all streams but are best developed in the estuary of the Brunswick River.

METHODS

The survey was carried out by a team of six, including the author, from March to November 1985. Investigations were concentrated in the largest remaining patches of natural vegetation in the Shire. Most of these patches occurred on vacant Crown land under the control of the Department of Lands, although vegetation on privately-owned land and in Nature Reserves managed by the National Parks and Wildlife Service was also investigated.

Survey Sites

Vertebrates were surveyed at a series of sites where systematic methods were employed. The survey area was divided into five approximately equal-sized land units based on landform (Fig. 1) and three major sites were chosen in each unit to sample the largest patches of vegetation. A number of minor sites were chosen to sample important smaller vegetation patches (such as ecotones, stands of flowering plants, swamps). The survey progressed from south to north and, because of time constraints, minor sites were not selected in the

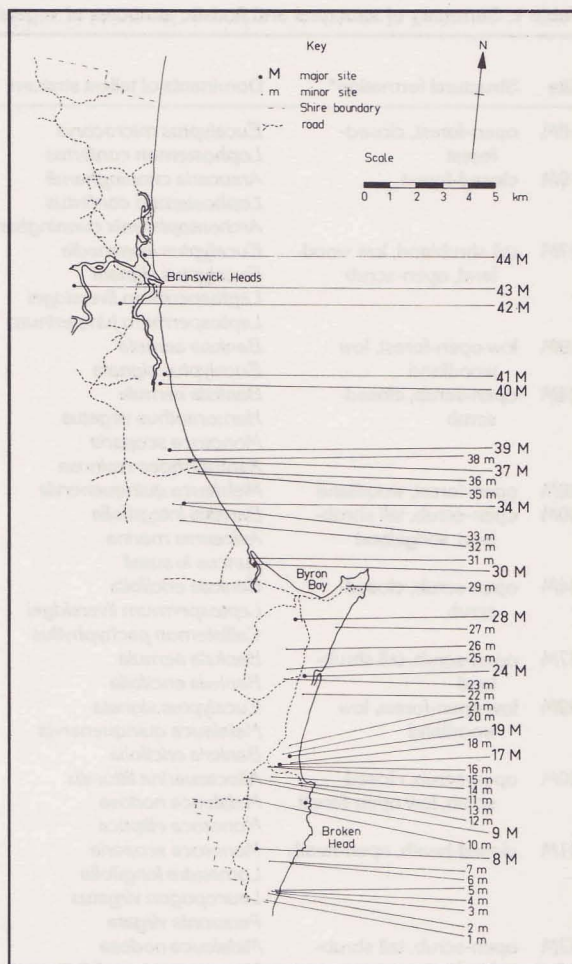


Figure 2. Locations of the 15 major and 29 minor sites surveyed in coastal Byron Shire.

northern third of the area. Locations of the 15 major and 29 minor sites surveyed are shown in Figure 2.

Major sites were surveyed for four consecutive days and nights within 1 ha using a set pattern of 34 40-cm deep, 25-cm diam. pit traps (without drift fences), four 40 m lines of mist nets (set for 5 hrs each morning), 100 medium-sized Elliott traps and five 50 × 20 × 20 cm cage traps (Fig. 3). Vegetation structure and floristics were assessed by four 22 × 22 m quadrats.

Minor sites were surveyed using 25 Elliott and three cage traps along a 240 m transect and vegetation was assessed by one quadrat at the transect centre.

In addition to the site-based methods, opportunistic searching for vertebrates was conducted throughout the survey area whenever time permitted.

Table 1. Summary of structural and floristic attributes of vegetation at major sites.

Site	Structural formation*	Dominants of tallest stratum	Habitat type(s)	Soil type #
8M	open-forest, closed-forest	<i>Eucalyptus microcorys</i>	wet sclerophyll forest	M
9M	closed-forest	<i>Lophostemon confertus</i> <i>Araucaria cunninghamii</i> <i>Lophostemon confertus</i> <i>Archontophoenix cunninghamiana</i>	coastal sub-tropical rainforest	M
17M	tall shrubland, low woodland, open-scrub	<i>Eucalyptus intermedia</i> <i>Eucalyptus signata</i> <i>Leptospermum liversidgei</i> <i>Leptospermum juniperinum</i>	dry sclerophyll woodland, tall wet heath	M
19M	low open-forest, low woodland	<i>Banksia aemula</i> <i>Eucalyptus signata</i>	dry sclerophyll forest, tall dry heath	S
24M	open-scrub, closed-scrub	<i>Banksia aemula</i> <i>Homoranthus virgatus</i> <i>Monotoca scoparia</i> <i>Xanthorrhoea resinosa</i>	tall dry heath	S
28M	open-forest, woodland	<i>Melaleuca quinquenervia</i>	swamp sclerophyll forest	S
30M	open-scrub, tall shrubland, sedgeland	<i>Banksia integrifolia</i> <i>Avicennia marina</i> <i>Juncus kraussii</i>	littoral scrub; mangrove, salt-marsh	S
34M	open-scrub, closed-scrub	<i>Banksia ericifolia</i> <i>Leptospermum liversidgei</i> <i>Callistemon pachyphyllus</i>	tall wet heath	S
37M	open-scrub, tall shrubland	<i>Banksia aemula</i> <i>Banksia ericifolia</i>	tall dry heath	S
39M	low open-forest, low woodland	<i>Eucalyptus signata</i> <i>Melaleuca quinquenervia</i> <i>Banksia ericifolia</i>	swamp sclerophyll woodland, dry sclerophyll woodland	M/S
40M	open-scrub, closed-scrub, low open-forest	<i>Allocasuarina littoralis</i> <i>Melaleuca nodosa</i> <i>Monotoca elliptica</i>	littoral scrub, dry sclerophyll woodland	S
41M	closed-heath, open-heath	<i>Monotoca scoparia</i> <i>Lomandra longifolia</i> <i>Leucopogon virgatus</i> <i>Persoonia virgata</i>	low dry heath	S
42M	open-scrub, tall shrubland	<i>Melaleuca nodosa</i> <i>Leptospermum whitei</i> <i>Banksia aemula</i> <i>Banksia ericifolia</i>	tall dry heath, tall wet heath	S
43M	open-forest, woodland	<i>Eucalyptus robusta</i> <i>Eucalyptus pilularis</i> <i>Lophostemon suaveolens</i>	swamp sclerophyll forest, wet sclerophyll forest	M/S
44M	low closed-forest, low open-forest, low woodland	<i>Avicennia marina</i>	mangrove	S

*after Specht *et al.* 1974. # soil type indicated as: M — derived from meta-sediments; S — formed from marine and/or alluvial deposits (Wallum habitats).

Names used follow Harden (1990–91) and Beadle (1971–87).

Table 2. Summary of structural and floristic attributes of vegetation at minor sites.

Site	Structural formation*	Dominants of tallest stratum	Habitat type(s)	Soil type #
1 m	closed-sedgeland	<i>Lepironia articulata</i>	sedgeland	S
2 m	closed-forest	<i>Araucaria cunninghamii</i>	littoral rainforest	S
3 m	open-scrub	<i>Cupaniopsis anacardioides</i> <i>Banksia integrifolia</i> <i>Mischocarpus pyramidalis</i>	littoral scrub	S
4 m	open-forest	<i>Melaleuca quinquenervia</i>	swamp sclerophyll forest	S
5 m	closed-sedgeland	<i>Lepironia articulata</i>	sedgeland	S
6 m	open-scrub	<i>Cupaniopsis anacardioides</i>	littoral scrub	S
7 m	low open-forest	<i>Allocasuarina torulosa</i> <i>Eucalyptus siderophloia</i>	dry sclerophyll forest	M
10 m	open-forest	<i>Melaleuca quinquenervia</i> <i>Lophostemon confertus</i>	swamp sclerophyll forest	M
11 m	closed-forest	<i>Archontophoenix cunninghamiana</i> <i>Glochidion sumatranum</i> <i>Acronychia imperforata</i> <i>Ficus watkinsoniana</i>	littoral rainforest	M
12 m	open-forest	<i>Eucalyptus pilularis</i> <i>Eucalyptus intermedia</i>	dry sclerophyll forest	M
13 m	woodland	<i>Eucalyptus pilularis</i>	dry sclerophyll woodland	M
14 m	open-forest	<i>Eucalyptus pilularis</i> <i>Eucalyptus intermedia</i> <i>Lophostemon confertus</i>	wet sclerophyll forest	M
15 m	open-forest	<i>Eucalyptus pilularis</i> <i>Eucalyptus intermedia</i>	dry sclerophyll forest	M
16 m	open-forest	<i>Eucalyptus intermedia</i> <i>Eucalyptus pilularis</i>	dry sclerophyll forest	M
18 m	low woodland	<i>Melaleuca quinquenervia</i>	swamp sclerophyll woodland	S
20 m	woodland	<i>Eucalyptus pilularis</i>	dry sclerophyll woodland	M/S
21 m	tall shrubland	<i>Banksia ericifolia</i> <i>Eucalyptus signata</i>	tall wet heath	S
22 m	open-scrub	<i>Banksia aemula</i> <i>Eucalyptus intermedia</i>	tall dry heath	S
23 m	open-forest	<i>Melaleuca quinquenervia</i>	swamp sclerophyll forest	M/S
25 m	open-forest	<i>Eucalyptus pilularis</i> <i>Lophostemon confertus</i>	dry sclerophyll forest	M
26 m	open-forest	<i>Melaleuca quinquenervia</i> <i>Eucalyptus robusta</i> <i>Commersonia bartramia</i> <i>Callicoma serratifolia</i>	swamp sclerophyll forest	M/S
27 m	open-heath	<i>Banksia oblongifolia</i>	low dry heath	S
29 m	closed-forest	<i>Lophostemon confertus</i>	coastal subtropical rainforest	M
31 m	sedgeland	<i>Schoenus brevifolius</i> <i>Andropogon virginicus</i>	sedgeland	S
32 m	open-forest	<i>Melaleuca quinquenervia</i> <i>Acacia melanoxylon</i>	swamp sclerophyll forest	S
33 m	open-forest	<i>Melaleuca quinquenervia</i> <i>Eucalyptus robusta</i>	swamp sclerophyll forest	S
35 m	recently burnt tall dry heath	S
36 m	tall shrubland	<i>Melaleuca quinquenervia</i> <i>Banksia integrifolia</i> <i>Lophostemon confertus</i> <i>Acacia longifolia</i> <i>Acacia suaveolens</i> <i>Leptospermum polygalifolium</i>	littoral scrub	S
38 m	open-forest	<i>Melaleuca quinquenervia</i>	swamp sclerophyll forest	S

*after Specht *et al.* 1974. # soil type indicated as: M — derived from meta-sediments; S — formed from marine and/or alluvial deposits (Wallum habitats).

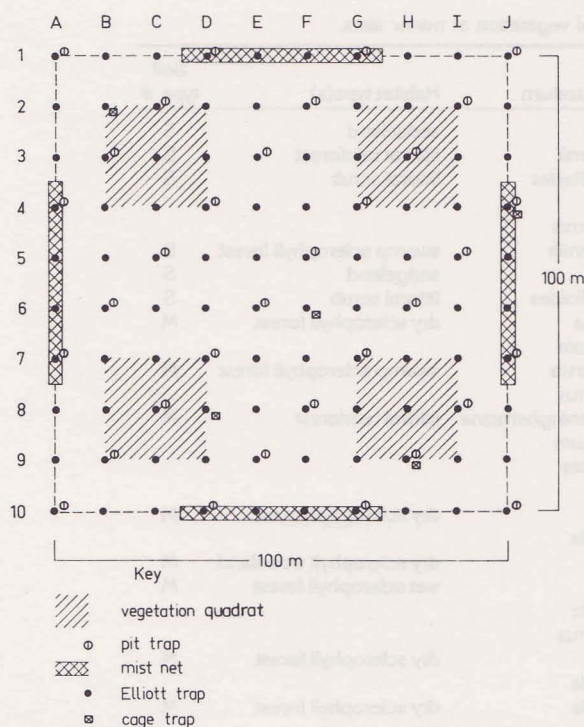


Figure 3. Diagram to show the pattern of methods employed at major survey sites.

RESULTS

Vegetation Types

Eleven structural vegetation formations (after Specht *et al.* 1974) were sampled by major and minor sites. A division of the structural types based on dominant plant species of the tallest strata enabled 14 wildlife habitat types to be identified (Tables 1 and 2). The most widespread and extensive habitat types sampled by major sites were tall dry heath, tall wet heath and dry sclerophyll woodland (Tables 1 and 2). These reflect the influence of episodic disturbance on the vegetation, a characteristic of Wallum habitats (Coaldrake 1961), and the prevalence of regrowth communities resulting from the extensive clearing which has occurred since European settlement (Planning Workshop 1983). Sclerophyll forest and rainforest were poorly represented and at the five major sites where they occurred (Table 1), were relatively poorly developed, exceeding 20 m in height at only one site (Fig. 4).

Vertebrates

A total of 239 species was recorded during the survey, comprising 15 species of amphibians, 19 species of reptiles, 182 species of birds and 23 species of mammals (Appendix 1). Eighty-one species were captured by systematic methods at major and minor sites (Appendix 1). The numbers of species of the four vertebrate groups captured at sites and by the different methods are given in Table 3.

Table 3. Numbers of species of vertebrate groups captured at major and minor sites and by systematic methods at all sites.

Species captured at major sites

amphibians	reptiles	birds	mammals	total species
6	4	53	14	77

Additional species captured at minor sites

amphibians	reptiles	birds	mammals	total species
—	1	—	3	4

Species captured by systematic methods

	pit traps	mist nets	Elliott traps	cage traps
amphibians	6	—	1	—
reptiles	3	—	1	—
birds	—	53	—	—
mammals	5	—	10	5
total species	14	53	12	5

Amphibians

The most common and widespread amphibian species recorded were the Brown-Striped Frog *Limnodynastes peronii*, Common Eastern Froglet *Ranidella signifiera*, Eastern Dwarf Tree Frog *Litoria fallax* and Cane Toad *Bufo marinus*, although the Cane Toad was mainly found in highly disturbed areas. Records of other frogs indicated more restricted distributions, with the Northern Banjo Frog *Limnodynastes terraereginae*, Wallum Froglet *Ranidella tinnula*, Freycinet's Frog *Litoria freycineti* and Wallum Tree Frog *L. longburensis* only encountered in habitats on the sandy soils of the coastal plain.

Reptiles

The most common and widely distributed reptile species were the Eastern Water Dragon *Physignathus lesueurii*, Grass Skink *Lampropholis delicata* and Three-toed Skink *Saiphos equalis*. Records of Burton's Snake-lizard *Lialis burtonis* and the Striped Skink *Ctenotus robustus* were restricted to habitats on the sandy soils of the coastal plain.

Table 4. Birds recorded taking nectar from flowering plants.

Birds	Plants											
	A	B	C	D	E	F	G	H	I	J	K	L
Rainbow Lorikeet					+			+				
Scaly-breasted Lorikeet			+		+			+		+		
Little Wattlebird			+		+			+				
Noisy Friarbird			+		+	+		+			+	
Little Friarbird					+							
Blue-faced Honeyeater											+	
Noisy Miner								+	+	+		
Lewin's Honeyeater	+	+	+		+		+	+	+	+		
Yellow-faced Honeyeater			+					+	+	+		
Brown Honeyeater	+		+	+	+			+		+	+	
White-cheeked Honeyeater			+	+	+	+	+	+	+	+	+	
Eastern Spinebill				+			+	+				+
Scarlet Honeyeater			+					+	+	+	+	+
Silvereye							+			+		
Months plants recorded flowering, 1985												
March			+					+				
April					+	+		+			+	
May					+			+			+	
June				+	+			+			+	+
July		+	+	+	+			+	+	+		
August			+									+
September					+					+		
October	+						+					

Key to plants: A, *Aegiceras corniculatum*; B, *Amylothea dictyophleba*; C, *Banksia aemula*; D, *B. ericifolia*; E, *B. integrifolia*; F, *B. oblongifolia*; G, *Callistemon salignus*; H, *Eucalyptus robusta*; I, *E. siderophloia*; J, *E. tereticornis*; K, *Melaleuca quinquenervia*; L, *Styphelia viridis*.

Birds

More than 30 species of birds were found to be common and widely distributed in the survey area. The most abundant and widespread were the Whistling Kite *Haliastur sphenurus*, Scaly-breasted Lorikeet *Trichoglossus chlorolepidotus*, White-browed Scrubwren *Sericornis frontalis*, Little Wattlebird *Anthochaera chrysoptera*, Lewin's Honeyeater *Meliphaga lewinii* and Silvereye *Zosterops lateralis*.

An important influence on bird communities during the survey were the flocks of nectivorous species concentrating at and moving between localized food sources provided by stands of flowering plants. Two species of lorikeets, 11 species of honeyeaters and the Silvereye were recorded taking nectar from 12 species of flowering plants (Table 4).

Movements of birds between nectar sources occurred throughout the survey period and flocks were observed either passing rapidly overhead or moving more slowly through or below the vegetation canopy (Table 5). Flocks passing overhead were mainly composed of one species, except for mixed flocks of Rainbow *Trichoglossus haematodus* and Scaly-breasted Lorikeets, and

those moving through vegetation were mainly mixed-species flocks. No flocks were composed of more than approximately 100 individuals.

Smaller concentrations of birds were observed feeding on fruits and seven species of frugivorous birds were recorded taking fruit from four species of plants (Table 6).

The effects of migration also influenced the occurrence of birds during the survey period and two distinct groups were apparent. One group, present during autumn and winter and absent during spring and summer, comprised southern-breeding species (migrating to southern New South Wales, Victoria and Tasmania, e.g., Marsh Harrier *Circus aeruginosus*) and species breeding at higher elevations in the hinterland (altitudinal migrants, e.g., Noisy Pitta *Pitta versicolor*). The other group, present during spring and summer and absent during autumn and winter, comprised locally-breeding species (migrating to north Queensland and the New Guinea region, e.g., Common Koel *Eudynamys scolopacea*) and species breeding in the northern hemisphere (trans-equatorial migrants, e.g., Latham's Snipe *Gallinago hardwickii*). Species of the different groups are indicated in Appendix 1.

Table 5. Birds recorded moving in flocks.

Birds forming flocks passing overhead	months recorded, 1985
medium-sized flocks (30–100 individuals)	
Scaly-breasted Lorikeet (± Rainbow Lorikeet)	April–September
Noisy Friarbird	April–July
Small flocks (up to 30 individuals)	
Rainbow Lorikeet	April–June
Little Lorikeet	June, August
Little Friarbird	June, July
Silveryeye	April, September
Birds forming flocks passing through at canopy or sub-canopy level	
medium-sized flocks (30–100 individuals)	
Little Wattlebird	June, August–September
Brown Honeyeater	June–September
Silveryeye	April–September
Small flocks (up to 30 individuals)	
Lewin's Honeyeater	July–August
Yellow-faced Honeyeater	June–July
White-cheeked Honeyeater	June–September
Eastern Spinebill	June, August
Scarlet Honeyeater	June, July

Table 6. Birds recorded feeding on fruits.

	Plants				
	<i>Pennantia cunninghamii</i>	<i>Polyscias elegans</i>	<i>Ficus watkinsiana</i>	<i>Elaeocarpus reticulatus</i>	
Birds					
Wompoo Fruit-dove		+	+		
White-headed Pigeon	+				
Brown Cuckoo-dove		+			
Lewin's Honeyeater		+			
Silveryeye		+			
Olive-backed Oriole		+			
Regent Bowerbird					+
Months plants recorded fruiting, 1985					
May	+				
July		+	+		
August					+

Mist-netting captures at major sites and general observations indicated that populations of some locally-breeding birds increased during autumn and winter and this probably also resulted from migration. Numbers of species such as the Black-faced Cuckoo-shrike *Coracina novaehollandiae*, Golden Whistler *Pachycephala pectoralis*, Grey Fantail *Rhipidura fuliginosa* and Olive-backed Oriole *Oriolus sagittatus* were most likely supplemented by individuals which bred further south and/or at higher elevations in the hinterland. Birds which exhibited increases in numbers during autumn and winter are indicated in Appendix 1.

Mammals

The most common and widely-distributed mammal species recorded were the Northern Brown Bandicoot *Isodon macrourus*, Grassland Melomys *Melomys burtoni*, Swamp Rat *Rattus lutreolus* and House Mouse *Mus musculus*. The Common Dunnart *Sminthopsis murina* and Common Planigale *Planigale maculata* were only captured in habitats on the sandy soils of the coastal plain and the Brown Antechinus *Antechinus stuartii* and Fawn-footed Melomys *Melomys cervinipes* appeared to be confined to habitats on soils derived from meta-sediments. The Bush Rat *Rattus fuscipes* was only trapped north of Tyagarah and in the southern part of the survey area its niche appeared to be partly filled by the Grassland Melomys and Swamp Rat. The introduced Black Rat *Rattus rattus* was only trapped in areas of current or recent human disturbance, where it co-occurred with the introduced House Mouse, although the House Mouse was found to persist in less recently-disturbed areas.

Observations of two species of megachiropteran bats feeding on nectar were made during the survey. Flocks of up to 30 Grey-headed Flying-foxes *Pteropus poliocephalus* were observed feeding at flowers of the Swamp Mahogany *Eucalyptus robusta* throughout the area from April to July, and the Queensland Blossom-bat *Syconycteris australis* was also observed feeding at flowers of the Swamp Mahogany in May. A temporary camp of approximately 40 Grey-headed Flying-foxes was present during March in an isolated stand of floodplain rainforest west of Byron Bay.

DISCUSSION

Factors Affecting Results and Success of the Methods

Some reptile and migratory bird species which are likely to occur in the survey area were probably not detected because of the lack of summer sampling. Several species of microchiropteran bats which are also likely to occur were probably overlooked because of the low trapping effort expended on this group.

The systematic methods proved most successful in detecting frogs and mammals. Forty and 74% respectively of the species totals for these groups were obtained using pit, Elliott and cage traps (Table 3). Only 26% of reptile species and 29% of bird species were captured in pit and Elliott traps and mist nets (Table 3).

Some important vertebrate groups were poorly sampled by the systematic methods. These comprised hylid frogs, medium-sized and large reptiles, birds which forage aerially or in the canopy of tall vegetation formations, nocturnal birds and large mammals.

Faunal Richness and Biogeographical Significance of the Survey Area

The survey results show that coastal Byron Shire has a rich and diverse vertebrate fauna with high numbers of amphibian, bird and mammal species, although reptiles appear to be poorly represented. The addition of records from other sources (Appendix 2) gives totals of 16 amphibian species, 31 reptile species, 254 bird species and 30 mammal species known to occur in the area. These totals represent approximately 9, 5, 42 and 11% respectively of the Australian terrestrial amphibian, reptile, bird and mammal faunas. Generally the area is characterized by vertebrate species with habitat preferences for low, dense vegetation. There are few forest-dependent species, particularly arboreal marsupials, which can be attributed to the absence of substantial tracts of mature forest.

A major factor contributing to the area's overall vertebrate species richness is its position at the centre of the Macleay-McPherson overlap zone, where the Bassian and Torresian faunas meet. As a consequence, many Bassian species are close to their northern limits and Torresian species close to their southern limits of distribution in the area (Appendices 1 and 2). Additionally the Wallum provides two endemics, the Wallum Froglet and Wallum Tree Frog.

Vertebrate Distribution Patterns

Distinct differences were evident between the vertebrate communities of habitats on low-lying coastal sands (Wallum) and those of habitats on soils derived from meta-sediments (on ridges and headlands). This was most pronounced among small, less-mobile species such as frogs and small mammals. Thus species found to characterize Wallum habitats in the area were the Northern Banjo Frog, Wallum Froglet, Wallum Tree Frog, Common Dunnart, Common Planigale and Grassland Melomys. The Brown Antechinus and Fawn-footed Melomys characterized vertebrate communities of habitats on meta-sediments. The Brown Antechinus and

Common Dunnart/Common Planigale appear to replace each other in the small predatory mammal niche in habitats on the two different substrates.

The distribution of the Bush Rat was puzzling because this normally common, widespread rodent (Lunney 1983a) was absent from apparently suitable habitats in the southern half of the survey area. However, much of this habitat has been extensively modified, fragmented and isolated since European settlement and it is possible that the Bush Rat has become locally extinct there as a result. Both the Grassland Melomys and Swamp Rat appear to have partly filled the vacant Bush Rat niche in the south of coastal Byron Shire, occupying dry sclerophyll woodland and dry and wet sclerophyll forests where they do not normally occur (Lunney 1983b, Redhead 1983).

Vertebrate Response to Habitat Variation

The results show little association between the richness and diversity of vertebrate species and the structural complexity and floristic diversity of the vegetation. For example, the species total for structurally and floristically diverse coastal subtropical rainforest (survey site 9M, Appendix 1) was lower than that for structurally simple and floristically less-diverse low dry heath (survey site 41M). The results for birds and mammals, the two groups contributing the majority of species, best illustrate the lack of response to structural or floristic variation, with species and numbers of individuals totals for survey sites in forest and woodland habitats often lower than for those in heath (Figs 4 and 5).

Results mainly appeared to reflect the availability of food resources at individual sites at the time of surveying. For example, the high numbers of bird species and individuals captured at some sites (e.g., 24M, 30M, 34M, 37M, 41M, Fig. 5) resulted from the prolific flowering of Wallum Banksia *Banksia aemula*, Heath-leaved Banksia *B. ericifolia* and Coast Banksia *B. integrifolia*. Additional evidence of the effect of seasonally-fluctuating food resources on bird numbers was provided by the results from structurally and floristically similar sites which were surveyed at different times of the year. Totals for site 34M which was dominated by the Heath-leaved Banksia and surveyed in winter when the plant was in flower, were much higher than totals for site 42M (Fig. 5), also dominated by the Heath-leaved Banksia, which was surveyed in spring after the plant had finished flowering.

Wildlife Conservation Significance of the Area

The survey results show that coastal Byron Shire is an area of major vertebrate conservation significance at

Figure 4. A comparison of the numbers of bird and mammal species captured by the trapping methods with the total bird and mammal species recorded and vegetation heights at major survey sites.

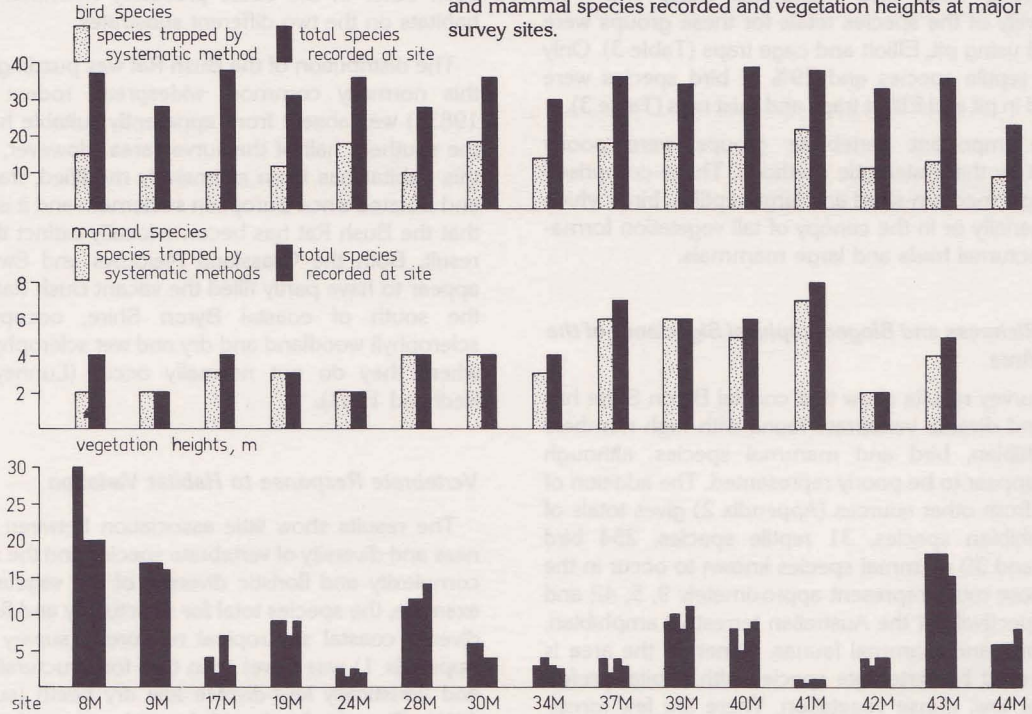
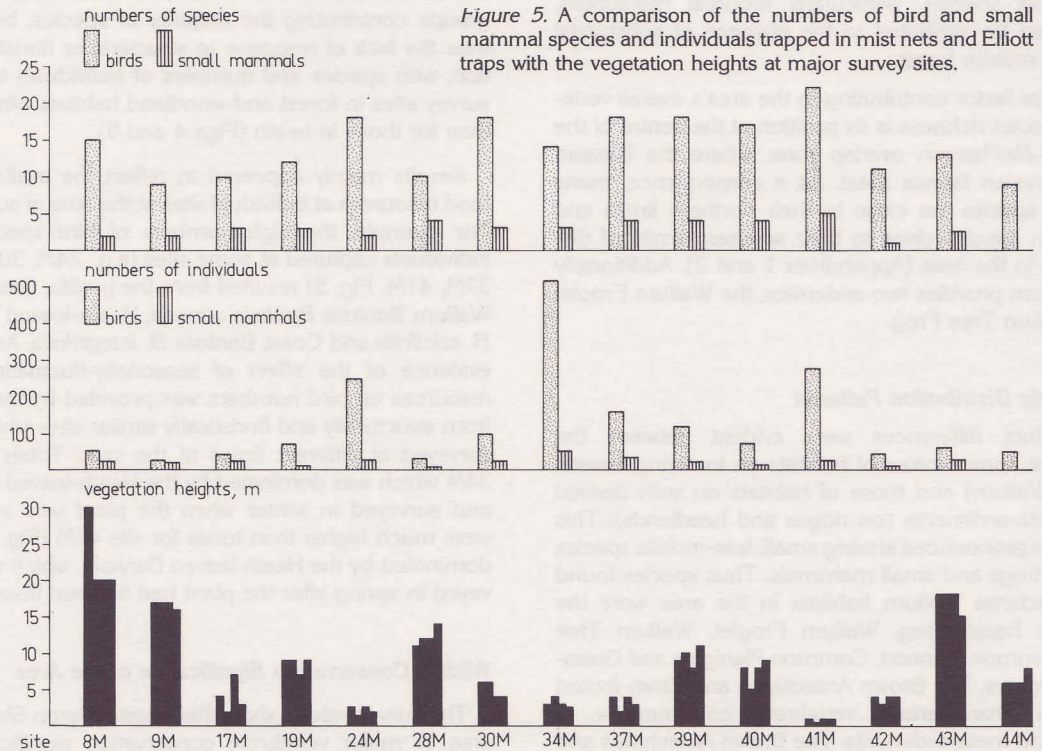


Figure 5. A comparison of the numbers of bird and small mammal species and individuals trapped in mist nets and Elliott traps with the vegetation heights at major survey sites.



Centre Spread Colour: Photos 2–12 by David Milledge.

1: The author photographing a Noisy Pitta *Pitta versicolor* captured at survey site 8M in wet sclerophyll forest near Broken Head. Photo by Peter Parker.

2: The Noisy Pitta *Pitta versicolor* was present during autumn and winter months as a non-breeding migrant to the survey area. Most individuals were probably altitudinal migrants from the high elevation rainforests and wet sclerophyll forests of the hinterland, although some may have been migrants from further south.

3: Diane Mackey and Schelion Probert digging in a pit trap in wet sclerophyll forest at survey site 43M on the Brunswick River. Pit traps were set for four consecutive days and nights and were most effective in capturing frogs and small mammals.

4: A Common Planigale *Planigale maculata* captured in a pit trap at survey site 43M. Pit trapping proved the most effective method for detecting this tiny carnivorous marsupial and it was trapped at a number of sites in heath, scrub and woodland habitats on old dunes of the coastal plain.

5: The Emerald Dove *Chalcophaps indica* was widely distributed throughout the survey area wherever suitable seed sources occurred. It was recorded from habitats varying from low dry heath to subtropical rainforest.

6: A Lewin's Honeyeater *Meliphaga lewinii* entangled in a mist net at survey site 17M before being banded and released. Mist netting and banding allowed an accurate assessment of the densities of flocks of nectivorous birds moving through the survey area.

7: A Wallum Tree Frog *Litoria olongburensis* perched on a stem of the sedge *Lepironia articulata*. This small tree frog is a Wallum endemic and was recorded only in Melaleuca forest and woodland growing in the swales between old dunes.

8: A number of species were detected by trapping methods targetted at other vertebrate groups. This Eastern Water Skink *Eulamprus quoyii* was captured at survey site 38m in an Elliott trap set for small terrestrial mammals.

9: An aerial view of coastal subtropical rainforest at Broken Head, south of Byron Bay. The vertebrate community of survey site 9M, near the centre of the photo, was characterized by species such as the Wompoo Fruit-dove *Ptilinopus magnificus*, Green Catbird *Ailuroedus crassirostris*, Brown Antechinus *Antechinus stuartii* and Fawn-footed Melomys *Melomys cervinipes*.

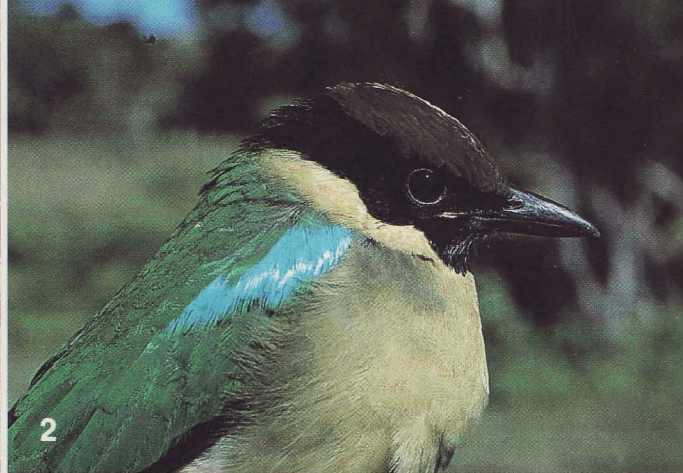
10: Coastal heathland dominated by Wallum Banksias *Banksia aemula* and Spear Grassrees *Xanthorrhoea resinosa* at Tallow Creek near Byron Bay. The most abundant vertebrates at survey site 24M here were nectivorous birds, particularly the Noisy Friarbird *Philemon corniculatus*, Lewin's Honeyeater *Meliphaga lewinii*, Brown Honeyeater *Lichmera indistincta*, White-cheeked Honeyeater *Phylidonyris nigra* and the Silveryeye *Zosterops lateralis*.

11: Swamp sclerophyll forest dominated by Broad-leaved Paperbark *Melaleuca quinquenervia* at Tyagarah, north of Byron Bay. Survey site 39M, located in the centre of the photo, was the most southerly site where the Bush Rat *Rattus fuscipes* was trapped during the survey. Other small mammals captured here included the Common Dunnart *Sminthopsis murina*, Common Planigale *Planigale maculata* and Grassland Melomys *Melomys burtoni*.

12: Estuarine intertidal flats and Grey Mangroves *Avicennia marina* at the mouth of Marshalls Creek, a tributary of the Brunswick River. The vertebrate community of survey site 44M in this mangrove forest appeared to be composed entirely of birds such as herons, egrets, ibises, kites, migratory waders, kingfishers and a few insectivorous passerines.



D. Milledge photographing a Noisy Pitta. Photo: P. Parker.



Noisy Pitta — Broken Head. Photo: D. Milledge.



Pit trapping — Brunswick River. Photo: D. Milledge.



Common Planigale in a pit trap — Brunswick River.
Photo: D. Milledge.



Emerald Dove — Tyagarah. Photo: D. Milledge.



Mist Netting — Lewin's Honeyeater — Taylor's Lake.
Photo: D. Milledge.



Litoria olongburensis — Broadwater N.P.
Photo: D. Milledge.



Eastern Water Skink — Tyagarah. Photo: D. Milledge.



Broken Head. Photo: D. Milledge.



Dry Heathland — Tallow Creek. Photo: D. Milledge.



Swamp sclerophyll forest — Tyagarah. Photo: D. Milledge.



Marshalls Creek. Photo: D. Milledge.

regional, state and national levels. The principal factors responsible for this are the presence of high numbers of endangered and other significant species and the area's importance in providing autumn and winter food resources for nomadic and migratory birds and fruit-bats.

Endangered and other Significant Species: Fourteen high priority endangered species (Part 2, Vulnerable and Rare Fauna and Part 3, Threatened Fauna, National Parks and Wildlife Act, 1974) and 12 additional significant vertebrates were recorded during the survey (Appendix 1). A further 11 high priority endangered species and four significant species are known to occur in the survey area (Appendix 2), giving a total of 41 species.

The species of highest conservation significance recorded was the Long-nosed Potoroo *Potorus tridactylus* and the three individuals captured at Tyagarah (site 32m) indicate the presence of a colony in the area. The record has special significance because the only other coastal populations of this marsupial known north of Sydney are near Gosford, Myall Lakes, Old Bar and Wardell (Schlager 1981) and Cudgen Lake (Milledge 1988). Several vulnerable and rare (Part 2, Schedule 12) species were found to be widespread in the area, including the Osprey *Pandion haliaetus*, Brahminy Kite *Haliastur indus*, Common Planigale and Grassland Melomys.

Nomadic and Migratory Birds and Fruit-bats: Throughout the period of the survey, results were influenced by numbers of birds and fruit-bats moving in response to fluctuating food resources.

These included nectivorous and frugivorous birds and fruit-bats and insectivorous birds, although nectivorous birds provided the highest numbers of species and

individuals. Major nectar producing plants were the Broad-leaved Paperbark *Melaleuca quinquenervia*, Swamp Mahogany, Wallum Banksia, Heath-leaved Banksia and Coast Banksia and their significance is demonstrated by the very high numbers of nectivorous birds mist-netted at sites where they were in flower (Table 7).

Wildlife Conservation Planning

Despite the vertebrate faunal richness and high densities of some vertebrates established during the survey, the impact of past land use in coastal Byron Shire has undoubtedly had a detrimental effect on many species. Past records (e.g., Liddy 1966) indicate numbers of nectivorous birds have declined, the Bush Rat may have become locally extinct in the south of the area and the widespread occurrence of the introduced Cane Toad, Black Rat and House Mouse suggest levels of predation and competition may be high in disturbed habitats. Many of the endangered and significant vertebrates exhibit a high degree of vulnerability. The "acid" frogs of the Wallum are particularly susceptible to disturbance resulting in changes to the pH of their breeding areas (Ingram and Corben 1975) and endangered species such as the Common Planigale and Long-nosed Potoroo have suffered substantial declines throughout their ranges since European settlement.

The rapidly expanding human population of coastal Byron Shire can be expected to place increasing pressures on existing vertebrate habitats. Because of the area's regional, state and national significance, particularly with regard to endangered species and nomadic and migratory birds and fruit-bats, the maintenance and rehabilitation of these habitats should be given the highest priority in future land use planning.

Table 7. Numbers of nectivorous birds mist-netted at survey sites where stands of nectar-producing plants were in flower.

Site	Month surveyed	Flowering plant species	Numbers of nectivorous bird species mist-netted, species:												ts/tn*
			A	B	C	D	E	F	G	H	I	J	K	L	
24M	July	<i>Banksia aemula</i>		1		42		24		32	37	11		77	7/224
30M	June	<i>B. integrifolia</i>		1	6	1	3	6	1	18	25		1	24	10/86
34M	July-August	<i>B. ericifolia</i>			5			47	10	9	295	4		123	7/493
37M	August	<i>B. aemula</i>	1		17	2		10		1	95		5	3	8/134
		<i>B. integrifolia</i>													
41M	September	<i>B. integrifolia</i>		7	14			13		8	162	1		8	7/213

*ts/tn — total species/total numbers. Key to nectivorous bird species: A Rainbow Lorikeet, B Scaly-breasted Lorikeet, C Little Wattlebird, D Noisy Friarbird, E Little Friarbird, F Lewin's Honeyeater, G Yellow-faced Honeyeater, H Brown Honeyeater, I White-cheeked Honeyeater, J Scarlet Honeyeater, K Eastern Spinebill, L Silveryeye.

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Appendix 1. Vertebrates recorded during the survey. Information is presented on the species and numbers of individuals captured at major survey sites, species captured at minor survey sites, species migrating to or through the survey area and species approaching the limits of their ranges in the area.

		Species recorded at major survey sites with numbers of individuals captured by the trapping methods. + indicates species present but not trapped.															
		Major survey sites															
		8M	9M	17M	19M	24M	28M	30M	34M	37M	39M	40M	41M	42M	43M	44M	A B C D E F G
Amphibians																	
	Brown-striped Frog																
	<i>Limnodynastes peronii</i>					1	1				9		1				
	Northern Banjo Frog																
	<i>L. terraereginae</i>					1						1	1				
	Red-backed Toadlet																
	<i>Pseudophryne coriacea</i>	+			2												
	Common Eastern Froglet																
	<i>Ranidella signifera</i>			+	+						14			+	+		
S	Wallum Froglet																
	<i>R. tinnula</i>				+					3							
	Green Tree Frog																
	<i>Litoria caerulea</i>																+
	Eastern Dwarf Tree Frog																
	<i>L. fallax</i>						+										
S	Freycinet's Frog																
	<i>L. freycineti</i>																+
	Dainty Green Tree Frog																
	<i>L. gracilenta</i>																+
	Broad-palmed Frog																
	<i>L. latopalmata</i>																+
	Rocket Frog																
	<i>L. nasuta</i>																+
S	Wallum Tree Frog																
	<i>L. olongburensis</i>																+
	Peron's Tree Frog																
	<i>L. peronii</i>																+
S	Laughing Tree Frog																
	<i>L. tyleri</i>																+
	Cane Toad																
	<i>Bufo marinus</i>		1			1					1						
Reptiles																	
	Long-necked Tortoise																
	<i>Chelodina longicollis</i>																+
	Burton's Snake-lizard																
	<i>Lialis burtonis</i>																+
	Common Scaly-foot																
	<i>Pygopus lepidopodus</i>										+				+		
	Bearded Dragon																
	<i>Pogona barbata</i>																+
	Jacky Lizard																
	<i>Amphibolurus muricatus</i>																+
	Eastern Water Dragon																
	<i>Physignathus lesuerii</i>		+				+										
	Lace Monitor																
	<i>Varanus varius</i>										+				+		

A — Species captured at minor survey sites (individual sites indicated for significant species).
 B — Species recorded in the survey area but not at survey sites.
 C — Migratory birds present in the survey area during autumn/winter; S — southern breeding; A — breeding at higher altitudes.
 D — Migratory birds present in the survey area during spring/summer; N — migrating to northern Aust./NG; NB — northern hemisphere breeding.
 E — Birds showing population increases in the survey area during autumn/winter.
 F — Bassian species close to the northern limits of their ranges.
 G — Torresian species close to the southern limits of their ranges.

+ indicates species present but not trapped.

Main results

7M 39M 40M 4

[illegible]

[illegible]

Major survey sites

	8M	9M	17M	19M	24M	28M	30M	34M	37M	39M	40M	41M	42M	43M	44M	A	B	C	D	E	F	G
Birds — continued																						
Latham's Snipe																						
<i>Gallinago hardwickii</i>																	+		NH			
Bar-tailed Godwit																	+		NH			
<i>Limosa lapponica</i>																	+		NH			
Sharp-tailed Sandpiper																	+		NH			
<i>Calidris acuminata</i>																	+		NH			
Curlew Sandpiper																	+		NH			
<i>C. ferruginea</i>																	+		NH			
Silver Gull																	+					
<i>Larus novaehollandiae</i>																	+					
Gull-billed Tern																	+					
<i>Gelochelidon nilotica</i>																	+					
Caspian Tern																	+					
<i>Hydroprogne caspia</i>																	+					
Common Tern																	+					
<i>Sterna hirundo</i>																	+		NH			
T Little Tern																	+		NH			
<i>S. albifrons</i>																	+		NH			
Crested Tern																	+					
<i>S. bergii</i>																	+					
Rose-crowned Fruit-dove																	+					
<i>Ptilinopus regina</i>																	+		N			
VR Wompoo Fruit-dove																						
<i>P. magnificus</i>			+																A			
Topknot Pigeon																			A			
<i>Lopholaimus antarcticus</i>																	+		A			
White-headed Pigeon																						
<i>Columba leucomela</i>	+		1	+	+				+												+	
Feral Pigeon																						
<i>C. livia</i>							+									+						
Spotted Turtle-dove																						
<i>Streptopelia chinensis</i>																	+					
Brown Cuckoo-dove																						
<i>Macropygia amboinensis</i>	+	+								+	+				+							
Peaceful Dove																						
<i>Geopelia placida</i>					+							+	+									
Bar-shouldered Dove																						
<i>G. humeralis</i>				+	+	+		+	+	+	+	4	+		+							
Emerald Dove																						
<i>Chalcophaps indica</i>	1			+		+					+	1	1	7								
Crested Pigeon																						
<i>Ocyphaps lophotes</i>													+									
Galah																						
<i>Cacatua roseicapilla</i>																	+					
Sulphur-crested Cockatoo																						
<i>C. galerita</i>																	+					
Rainbow Lorikeet																						
<i>Trichoglossus haematodus</i>			+	+					1													

[illegible]

	Major survey sites																						
	8M	9M	17M	19M	24M	28M	30M	34M	37M	39M	40M	41M	42M	43M	44M	A	B	C	D	E	F	G	
<i>Birds — continued</i>																							
Richard's Pipit																							
<i>Anthus novaeseelandiae</i>																	+						
Black-faced Cuckoo-shrike																							
<i>Coracina novaehollandiae</i>					+				+		+	+	+	+							+		
Cicadabird																							
<i>C. tenuirostris</i>	1					+								+					N				
Varied Triller																							
<i>Lalage leucomela</i>	+	+	+			+		+	+	+	3	+	+	+									
Rose Robin																							
<i>Petroica rosea</i>																	+	A					
Eastern Yellow Robin																							
<i>Eopsaltria australis</i>	4	8	+	+		+			3	6	5		+	7									
Golden Whistler																							
<i>Pachycephala pectoralis</i>	5	2		6	2	1		3	4	8	4										+		
Rufous Whistler																							
<i>P. rufiventris</i>					1	1	2	1	3	+	+		1	+							+		
Little Shrike-thrush																							
<i>Colluricincla megarrhyncha</i>	6	2		2		2				2	3			4									
Grey Shrike-thrush																							
<i>C. harmonica</i>				1	1	1	1		2	+	+	1	3	1	+								
Black-faced Monarch																							
<i>Monarcha melanopsis</i>	1					+					+			+					N				
Spectacled Monarch																							
<i>M. trivirgatus</i>	1					+								2					N				
VR White-eared Monarch																							
<i>M. leucotis</i>																	+					+	
Leaden Flycatcher																							
<i>Myiagra rubecula</i>						+				+	+			+	3				N				
Restless Flycatcher																							
<i>M. inquieta</i>																	+						
Rufous Fantail																							
<i>Rhipidura rufifrons</i>	3													+					N				
Grey Fantail																							
<i>R. fuliginosa</i>	5	1	1	1		1	1	+		2	3			1	3					+			
Willie-wagtail																							
<i>R. leucophrys</i>							+	+	+						+								
Eastern Whipbird																							
<i>Psophodes olivaceus</i>	1	+	1	+		+			2	1	2	3		6									
Clamorous Reed-warbler																							
<i>Acrocephalus stentoreus</i>																	+						
Tawny Grassbird																							
<i>Megalurus timoriensis</i>			3		1		3	2				7											
Little Grassbird																							
<i>M. gramineus</i>							+																
Golden-headed Cisticola																							
<i>Cisticola exilis</i>							+																
Superb Fairy-wren																							
<i>Malurus cyaneus</i>							1				3	3											

	Variegated Fairy-wren <i>M. lamberti</i>	+	1	+	2	1	6	2	9	2	4	2	8	2	3				
S	Red-backed Fairy-wren <i>M. melanocephalus</i>					4							9	1		1			
	Southern Emu-wren <i>Stipiturus malachurus</i>							+											+
	Large-billed Scrubwren <i>Sericornis magnirostris</i>	1	+								3				9				
	White-browed Scrubwren <i>S. frontalis</i>	5	9	6	9		18		3	4	7	5	4	5	6				
	Brown Gerygone <i>Gerygone mouki</i>			+													A		
	Mangrove Gerygone <i>G. laevigaster</i>															13			
	White-throated Gerygone <i>G. olivacea</i>																	+	
	Brown Thornbill <i>Acanthiza pusilla</i>	+	2	3	4		+	+	1	1	4	7		4	+				
	White-throated Treecreeper <i>Climacteris leucophaea</i>																	+	
	Little Wattlebird <i>Anthochaera chrysoptera</i>	+		+	+		+	6	5	+	+	1	14						
	Noisy Friarbird <i>Philemon corniculatus</i>	+		+	+	42		1	+	2		+							+
	Little Friarbird <i>P. citreogularis</i>			+		+		3											+
	Blue-faced Honeyeater <i>Entomyzon cyanotis</i>																	+	
	Noisy Miner <i>Manorina melanoecephala</i>			+															
	Lewin's Honeyeater <i>Meliphaga lewinii</i>	15	4	13	9	24	1	6	47	10	13	8	13	2	13	9			
	Yellow-faced Honeyeater <i>Lichenostomus chrysops</i>			5		+		1	10			+							
	White-throated Honeyeater <i>Melithreptus albogularis</i>																	+	
	Brown Honeyeater <i>Lichmera indistincta</i>				2	32		18	9	1	1	3	8			2			
	White-cheeked Honeyeater <i>Phylidonyris nigra</i>			11	3	37		25	295	95	6	13	162	22					
	Eastern Spinebill <i>Acanthorhynchus tenuirostris</i>			+	4			1		5	2	1							
	Scarlet Honeyeater <i>Myzomela sanguinolenta</i>	+	+	+	+	11			4		1		1						
	Mistletoebird <i>Dicaeum hirundinaceum</i>	+	+	+	+			+											
	Spotted Pardalote <i>Pardalotus punctatus</i>			+						+	1	+				+			
	Striated Pardalote <i>P. striatus</i>			+						+		+	2			+			
	Silvereye <i>Zosterops lateralis</i>	+	+	1	28	77	+	4	123	3	49	4	8	+		16		S	
	House Sparrow <i>Passer domesticus</i>					+													
	Red-browed Firetail <i>Emblema temporalis</i>			1		7	+		4	1	4	5	15	2					

Appendix 1 — continued

Species recorded at major survey sites with numbers of individuals captured by the trapping methods.
+ indicates species present but not trapped.

	Major survey sites																						
	8M	9M	17M	19M	24M	28M	30M	34M	37M	39M	40M	41M	42M	43M	44M	A	B	C	D	E	F	G	
Birds — continued																							
Double-barred Finch																							
<i>Poephila bichenovii</i>			+		+				+			+											
Chestnut-breasted Mannikin																							
<i>Lonchura castaneothorax</i>																		+					
Common Starling																		+					
<i>Sturnus vulgaris</i>																		+					
Olive-backed Oriole																							
<i>Oriolus sagittatus</i>		+	+		1	+	1			+	+	1	+							+			
Figbird																							
<i>Sphecotheres viridis</i>	+	+		+		+																	
Spangled Drongo																							
<i>Dicrurus hottentottus</i>	1	+	+	+			+	+			+	+		+						+			
Regent Bowerbird																							
<i>Sericulus chrysocephalus</i>										4													
Green Catbird																							
<i>Ailuroedus crassirostris</i>		+																					
Australian Magpie-lark																							
<i>Grallina cyanoleuca</i>									+														
White-breasted Woodswallow																							
<i>Artamus leucorhynchus</i>	+								+	+	+	+	+										
Grey Butcherbird																							
<i>Cracticus torquatus</i>			+	+						+													
Pied Butcherbird																							
<i>C. nigrogularis</i>							+		+	+		+											
Australian Magpie																							
<i>Gymnorhina tibicen</i>		+																					
Pied Currawong																							
<i>Strepera graculina</i>	+	+				+									+								
Torresian Crow																							
<i>Corvus orru</i>	+	+	+		+			+	+	+	+	+	+	+	+								
Mammals																							
Platypus																							
<i>Ornithorhynchus anatinus</i>																		+					
Short-beaked Echidna																							
<i>Tachyglossus aculeatus</i>																		+					
Brown Antechinus																							
<i>Antechinus stuartii</i>	24	19	10	5													+						
Common Dunnart																							
<i>Sminthopsis murina</i>									4	1	3	1											
Common Planigale																							
<i>Planigale maculata</i>									1	2	1	1		2								+	
Northern Brown Bandicoot																							
<i>Isodon macrourus</i>						1	2		1			1	1				+						
Long-nosed Bandicoot																							
<i>Perameles nasuta</i>																16m							
Common Ringtail Possum																							
<i>Pseudocheirus peregrinus</i>																	+						

Mountain Brushtail Possum <i>Trichosurus caninus</i>									1								+
T Long-nosed Potoroo <i>Potorous tridactylus</i>																	32m
Swamp Wallaby <i>Wallabia bicolor</i>							+	+		+	+		+				
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>																+	
S Queensland Blossom-bat <i>Syconycteris australis</i>	+																+
S North Queensland Long-eared Bat <i>Nyctophilus bifax</i>	+																+
Water-rat <i>Hydromys chrysogaster</i>																	11m
Fawn-footed Melomys <i>Melomys cervinipes</i>	4	3															
VR Grassland Melomys <i>M. burtoni</i>				11	5		2		14	18	15	7	1		2	+	+
Bush Rat <i>Rattus fuscipes</i>											1		1		19		
Swamp Rat <i>R. lutreolus</i>				6	3	9	4	8	26	6		4	11	10	7	+	
Black Rat <i>R. rattus</i>							2	5								+	
House Mouse <i>Mus musculus</i>						23		13	11	13	7	6	14			+	
Rabbit <i>Oryctolagus cuniculus</i>																	+
Fox <i>Vulpes vulpes</i>																	+

Names used follow Cogger (1986) for amphibians and reptiles, Blakers *et al.* (1984) for birds, and Strahan (1983) for mammals.

Species notated VR or T are high priority endangered fauna classified under Parts 2 (Vulnerable and Rare Fauna) or 3 (Threatened Fauna) of the National Parks and Wildlife Act (1974).

Species notated S are considered regionally significant because they are approaching the limits of their ranges in the area or exist in low numbers in New South Wales (data from Ingram and Corben 1975; Morris *et al.* 1981; Pizzey 1980; Schlager 1981; and pers. comm. L. Gibson, G. Ingram and H. Parnaby).

Amphibians

Ornate Burrowing Frog *Limnodynastes ornatus*

VR

Reptiles

VR River Turtle *Emydura signata*
 Major Skink *Egernia frerei*
 Challenger's Skink *Saproscincus challengeri*
 Yellow-bellied Skink *Eulamprus tenuis*
 Pink-tongued Skink *Tiliqua gerrardii*
 Eastern Blue-tongued Skink *T. scincoides*
 Blind Snake *Ramphotyphlops nigrescens*
 Brown Tree Snake *Boiga irregularis*
 Common Death Adder *Acanthophis antarcticus*
 VR Dwarf Crowned Snake *Cacophis kreftii*
 Red-bellied Black Snake *Pseudechis porphyriacus*
 Eastern Brown Snake *Pseudonaja textilis*

TSL

BNL

Birds

Hoary-headed Grebe *Poliocephalus poliocephalus*
 Little Bittern *Ixobrychus minutus*
 Black Bittern *Dupetor flavicollis*
 Glossy Ibis *Plegadis falcinellus*
 VR Magpie Goose *Anseranas semipalmata*
 Wandering Whistling Duck *Dendrocygna arcuata*
 Plumed Whistling Duck *D. eytoni*
 T Freckled Duck *Stictonetta naevosa*
 Chestnut Teal *Anas castanea*
 Australasian Shoveler *A. rhynchotis*
 Pink-eared Duck *Malacorhynchus membranaceus*
 Maned Duck *Chenonetta jubata*
 Wedge-tailed Eagle *Aquila audax*
 Spotted Harrier *Circus assimilis*
 VR Peregrine Falcon *Falco peregrinus*
 Stubble Quail *Coturnix novaezealandiae*
 King Quail *C. chinensis*
 Painted Button-quail *Turnix varia*
 Spotless Crake *Porzana tabuensis*
 Comb-crested Jacana *Irediparra gallinacea*
 T Bush Thick-knee *Burhinus magnirostris*
 VR Beach Thick-knee *B. neglectus*
 Grey Plover *Pluvialis squatarola*
 Ruddy Turnstone *Arenaria interpres*
 Little Curlew *Numenius minutus*
 Wandering Tattler *Tringa incana*
 Greenshank *T. nebularia*
 Terek Sandpiper *T. terek*
 Black-tailed Godwit *Limosa limosa*
 Red Knot *Calidris canutus*
 Great Knot *C. tenuirostris*

TSL

Red-necked Stint *C. ruficollis*
 Sanderling *C. alba*
 Kelp Gull *Larus dominicanus*
 Whiskered Tern *Chlidonias hybrida*
 White-winged Tern *C. leucoptera*
 White-fronted Tern *Sterna striata*
 Superb Fruit-dove *Ptilinopus superbus*
 Common Bronzewing *Phaps chalcoptera*
 S Brush Bronzewing *P. elegans* BNL
 Wonga Pigeon *Leucosarcia melanoleuca*
 Glossy Black-cockatoo *Calyptorhynchus lathami*
 Yellow-tailed Black-cockatoo *C. funereus*
 Cockatiel *Nymphicus hollandicus*
 T Ground Parrot *Pezoporus wallicus* BNL
 Budgerigar *Melopsittacus undulatus*
 Crimson Rosella *Platycercus elegans*
 Oriental Cuckoo *Cuculus saturatus*
 Channel-billed Cuckoo *Scythrops novaehollandiae*
 VR Eastern Grass Owl *Tyto longimembris* TSL
 White-rumped Swiftlet *Collocalia spodiopygia*
 Fork-tailed Swift *Apus pacificus*
 VR Collared Kingfisher *Haycyon chloris* TSL
 White-winged Triller *Lalage sueurii*
 White's Thrush *Zoothera dauma* (= *heinei*)
 S Scarlet Robin *Petroica multicolor* BNL
 Jacky-winter *Microeca leucophaea*
 Pale-yellow Robin *Tregallasia capito*
 Yellow-rumped Thornbill *Acanthiza chrysorrhoa*
 Yellow Thornbill *A. nana*
 Striated Thornbill *A. lineata*
 Varied Sittella *Daphoenositta chrysoptera*
 Red Wattlebird *Anthochaera carunculata*
 Striped Honeyeater *Plectorhyncha lanceolata*
 S Mangrove Honeyeater *Lichenostomus fasciularis* TSL
 White-naped Honeyeater *Melithreptus lunatus*
 European Goldfinch *Carduelis carduelis*
 Nutmeg Mannikin *Lonchura punctulata*
 Satin Bowerbird *Ptilonorhynchus violaceus*
 Masked Woodswallow *Artamus personatus*
 White-browed Woodswallow *A. superciliosus*
 Dusky Woodswallow *A. cyanopterus*

Mammals

Koala *Phascolarctos cinereus*
 Sugar Glider *Petaurus breviceps*
 S Black Flying-fox *Pteropus alecto* TSL
 Gould's Long-eared Bat *Nyctophilus gouldi*
 Little Cave Eptesicus *Eptesicus pumilus*
 Brown Hare *Lepus capensis*
 Dingo *Canis familiaris*



Above: Scarlet Honeyeater — Suffolk Park. Photo: D. Milledge.

Below: Queensland Blossom-bat — Broken Head. Photo: D. Milledge.

